

I claim:

- 1 **1.** An apparatus comprising a first resonator, wherein said first resonator
2 comprises:
3 a resonating element, wherein said resonating element has a resonant
4 frequency and nodal points;
5 a first electrode, wherein said first electrode underlies said resonating element
6 and is separated from said resonating element by a first gap;
7 at least one support, wherein:
8 said support has a first end and a second end;
9 said first end of said support and said resonating element are joined
10 at one of said nodal points; and
11 said support has a length that is less than one-quarter wavelength
12 of said resonant frequency.
- 1 **2.** The apparatus of claim 1 wherein said resonating element is a beam.
- 1 **3.** The apparatus of claim 1 comprising four supports, wherein each of said
2 supports and said resonating element are joined at a respective one of said nodal
3 points.
- 1 **4.** The apparatus of claim 1 comprising an anchor that is attached to a ground
2 plane, wherein said second end of said support and said anchor are joined.
- 1 **5.** The apparatus of claim 1 wherein said length of said support is less than one-
2 half of a length of said resonating element.
- 1 **6.** The apparatus of claim 1 wherein said length of said support is less than one-
2 quarter of a length of said resonating element.
- 3 **7.** The apparatus of claim 1 wherein said length of said support is not more than
4 5 microns.
- 1 **8.** The apparatus of claim 1 wherein said length of said support is not more than
2 2 microns.

1 **9.** The apparatus of claim 8 wherein a width of said support is not more than 2
2 microns and a thickness of said support is not more than 2 microns.

1 **10.** The apparatus of claim 1 wherein said length of said support is not more
2 than 1 micron.

1 **11.** The apparatus of claim 1 wherein said length of said support is equal to a
2 width of said support.

1 **12.** The apparatus of claim 1 wherein said first gap has a minimum size when a
2 bias voltage is applied, and wherein said minimum size is determined by an amplitude
3 of said bias voltage.

1 **13.** The apparatus of claim 1 wherein said resonating element comprises a
2 material selected from the group consisting of silicon, diamond and metals.

1 **14.** The apparatus of claim 1 wherein said first electrode is electrically connected
2 to a source of an excitation voltage and wherein said resonating element is
3 electrically connected to a source of a bias signal.

1 **15.** The apparatus of claim 1 comprising a second resonator, wherein said second
2 resonator has a second resonating element, and wherein said second resonating
3 element has a second resonant frequency and is mechanically coupled to said
4 resonating element.

1 **16.** The apparatus of claim 14 wherein said apparatus is a filter.

1 **17.** The apparatus of claim 1 wherein said apparatus is an oscillator.

1 **18.** The apparatus of claim 1 further comprising a second electrode, wherein said
2 second electrode overlies said resonating element and is separated from said
3 resonating element by a second gap.

1 **19.** An apparatus comprising:

2 a resonating element, wherein said resonating element has:

3 a resonant frequency;

4 a first end and a second end;

5 a first nodal point proximal to said first end; and

6 a second nodal point proximal to said second end;

7 an electrode, wherein said electrode underlies said resonating element
8 between said first nodal point and said second nodal point, and further wherein
9 said electrode is separated from said resonating element by a gap;

10 a first support, wherein:

11 said first support has a first end and a second end; and

12 said first end of said first support and said resonating element are
13 joined at said first nodal point;

14 a second support, wherein:

15 said second support has a first end and a second end; and

16 said first end of said second support and said resonating element
17 are joined at said second nodal point;

18 and wherein said first support and said second support each have a length
19 that is less than one-eighth wavelength of said resonant frequency.

1 **20.** An apparatus comprising:

2 resonating means, wherein said resonating means is characterized by a
3 resonant frequency and flexural nodal points;

4 support means for supporting said resonating means, wherein said support
5 means is coupled to said resonating means proximal to at least one of
6 said flexural nodal points, wherein said support means has a length
7 that is less than one quarter of said resonant frequency.

1 **21.** An apparatus comprising a resonator, wherein said resonator comprises:

2 a resonating element having flexural nodal points; and

3 at least two supports, wherein said two supports and said resonating element
4 are mechanically coupled proximal to two of said flexural nodal points, and
5 wherein said two supports each have a length that is less than one-quarter
6 wavelength of said resonant frequency.

1 **22.** An apparatus comprising a resonator, wherein said first resonator comprises:
2 a resonating element, wherein said resonating element is characterized by a
3 resonant frequency, and has a first end and a second end;
4 an electrode, wherein said electrode underlies said resonating element, wherein
5 said electrode is separated from said resonating element by a gap;
6 a first support, wherein:
7 said first support has a first end and a second end; and
8 said first end of said first support and said resonating element are joined
9 proximal to said first end of said resonating element;
10 a second support, wherein:
11 said second support has a first end and a second end; and
12 said first end of said second support and said resonating element are
13 joined proximal to said second end of said resonating element;
14 and wherein said first support and said second support each have a length that is less
15 than one-eighth wavelength of said resonant frequency.